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SAWDUST

AND OTHER NATURAL ORGANICS

for turf establishment

and soil improvement

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SAWDUST AND OTHER NATURAL ORGANICS FOR ESTABLISHING TURF AND SOIL IMPROVEMENT

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INTRODUCTION

Gardeners and turf keepers frequently use natural organics of low fertilizer value, because when properly used these materials have valuable soil-conditioning effects. Sometimes it is said that they make the fertilizer more effective. The usefulness of such materials appears to vary in different localities and with different kinds of soil. Furthermore, mixtures of these organics are sometimes reported to be more effective than a single type of material used alone.

It is assumed, with some basis, that decomposable organics tend to improve the structure and tilth of soils whose contents of clay and silt are high. When used on soils that consist mostly of sand, the base exchange capacity is increased and the water-holding capacity is improved. Unfortunately, the experimental evidence supporting use of organics, such as sawdust and digested sewage sludge, is not extensive. A discussion of the subject is justified to some extent, however, by observations made from field practice not under controlled conditions as in experiments.

It is the purpose here to review the properties of some of the low-analysis organics that might be available to a gardener, examine certain data from field experiments, and consider the experiences of several users of natural organics, for turf and shrubbery in particular.

GOOD-QUALITY ORGANICS

Good quality organics, such as cottonseed meal and activated sewage sludge, have an established place as nitrogenous fertilizers for lawns and shrubbery. They are normally much more expensive, however, on a nitrogen basis than are the solid forms of chemical nitrogen as ammonium nitrate and urea. A summary of pertinent data for good quality organics is given in table 1. Contrast these values with those of certain natural organic soil-conditioning materials in table 2 with which we are now particularly concerned. These organic conditioners include such materials as sawdust, digested sewage sludge, reed and sedge peat, and garbage composts.

Natural organic materials are frequently looked upon as potential carriers of fertilizer nitrogen. This constituent may be small, however, and the cellulose, and to some extent other carbohydrates present, may even require additional nitrogen for their

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decomposition. A large part of the cellulose present may be expected to decompose relatively rapidly under favorable conditions. On the other hand, lignin and lignin-like materials decompose much slower and tend to accumulate to the advantage of soil tilth as decomposition takes place.

Data in table 3 gives some idea of the cellulose and lignin contents of a few natural organics that are sometimes available for soil improvement.

Digested sewage sludge is normally decomposed under water in the absence of air for a period of 10 to 14 days. During this time a large amount of methane gas is formed.

TABLE 1.--Primary plant-nutrient contents of good quality organic nitrogen carriers.

Material	Plant nutrients		
	Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)
	Percent	*Percent*	*Percent*
Activated sewage sludge	5.5	5.5	0.4
Cottonseed meal	7	2.5	1.5
Meat meal	10	2.5	--
Castor pumice	5.5	1.7	1.3

TABLE 2.--Primary plant-nutrient contents of common natural organic soil-conditioning materials.

Material	Plant nutrients		
	Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)
	Percent	*Percent*	*Percent*
Sawdust	0.2	0.1	0.2
Sphagnum moss and peat (peat moss)	1.0	.05	.04
Reed and sedge peat	1.9	.1	.05
Digested sewage sludge	2.0	1.1	.2
Miscellaneous composts	1.7	1.4	.9
Farm manure	1.2	.6	1.2

TABLE 3.--Proximate cellulose and lignin contents of certain natural organics.

Material	Cellulose	Lignin or lignin-like materials
	Percent	*Percent*
Sawdust (1)[2]	47 to 58	18 to 28
Sphagnum moss peat (3,7)	13 to 17	18 to 19
Reed and sedge peat (3,7)	3 to 5	35 to 49
Digested sewage sludge (2)	Low	High
Raw garbage	High	Moderate
Garbage compost	Moderate	High

[2] Numbers in parentheses refer to Literature Cited, at end of the paper.

It may be assumed that much of the carbohydrate originally present is decomposed, while lignin is transformed much more slowly. Furthermore, the bacterial residues that accumulate during decomposition may be assumed to have relatively high nitrogen content, although not rapidly decomposable.

Farmers who apply raw garbage to land have frequently observed that the first crop grown after application shows very little benefit from raw garbage, but a later crop may be considerably benefited. Garbage compost may or may not furnish substantial quantities of available nitrogen to plants soon after its addition to soil. Rate of action depends upon the nature and amount of nitrogen compounds present and upon the content of carbohydrate material remaining in the organic mixture.

QUANTITIES OF ORGANICS AVAILABLE

Large tonnages of certain natural organics are available on a nationwide basis. Unfortunately, however, large production of them is often in a locality where soils and crops are not particularly well suited for utilization of such materials. The national production of sawdust is enormous. It accumulates in lumbering areas of the Northwest and its disposal sometimes is a problem. Furthermore, there appears to be very limited use of sawdust for soil improvement in areas where so much is produced.

Sawdust is also produced in considerable quantities in the southeastern States, where extensive areas of sandy soil prevail. This does not mean that the sawdust is without value for soil improvement under such conditions. It does mean, however, that in many cases the sawdust is improved by composting with other organics having lower cellulose content and that additional nitrogen often is essential.

Domestic peat bogs cover many acres of land in several States. The potential tonnages of peat are listed according to the U. S. Bureau of Mines (10) by States (table 4). The data indicate that there is an abundant potential supply of peat in the United States, adequate for use over a period of many years for soil improvement. The large supplies are, however, often located in areas remote from places of probable use. Furthermore, costs involved in draining, harvesting, dewatering, shredding, and marketing often cause a potential buyer to pause before making extensive purchases. Domestic peat of reed and sedge origin is often better for soil improvement than the peat of sphagnum moss type essentially of foreign origin (8).

Large tonnages of digested sewage sludge are produced in the cities of the United States (2). This process of sewage disposal appears to be the most prevalent one. The

TABLE 4.--Original reserves of peat in the United States estimated on an air-dry basis, by States (10).

State	Reserves
	Thousand short tons
Minnesota	6,835,000
Wisconsin	2,500,000
Florida	2,000,000
Michigan	1,000,000
Virginia and North Carolina	700,000
New York	480,000
Maine	100,000

solids are produced in wet form and dewatering is costly. Heat treatment is desirable when such materials are for use around homes. Furthermore, municipalities usually insist on a market that will pay heat-drying costs before installation of equipment is authorized. An estimate of the solids delivered to sewers of the United States is 3,100,000 tons annually. The potential recovery of these solids is only about 30 percent. This means that about 570,000 tons are recoverable in sedimentation systems in operation and 380,000 tons in the activated systems. The actual recovery is only about 110,000 tons in sedimentation systems and 75,000 tons in activated materials. Tonnages available to consumers are relatively small because--owing to high recovery cost--sludge is incinerated, carried on barges out to sea, or allowed to pass into streams (6).

Toth and Kelley of the New Jersey Agricultural Experiment Station (11) have compiled information regarding the quantities of various organic wastes available in that State, and have included certain analytical data. Some of the more important items are listed in table 5.

TABLE 5.--Approximate amounts of various organic wastes available annually in New Jersey, and plant-nutrient contents of each (dry basis) (11).

Material	Annual Production	Plant nutrient content		
		Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)
	Tons	*Percent*	*Percent*	*Percent*
Sawdust	20,000	0.12	0.002	0.12
Sewage sludge	109,000	2.25	1.50	1.70
Coffee grounds	160,000	1.84	.03	.12
Garbage	1,152,000	1.07	1.16	.83
Spent hops	1,702	2.13	.66	.42

FIELD DATA

Field data involving the use of organics of low plant-nutrient contents for the improvement of turf or shrubbery are very scarce. The results of a 4-year field trial made at Pennsylvania State University (9), however, are available. A general picture of the properties of materials used in these experiments is given in table 6. Each of the organics, with the exception of mushroom soil, contains about 90 percent of organic matter.

TABLE 6.--Physical and chemical properties of materials used in construction of golf-green plots (9).

Material	Organic matter	Nitrogen	pH	Water-holding capacity
	Percent	*Percent*		*Percent*
Soil	3.0	0.14	6.6	56
Cocoa shells	93.9	2.7	5.5	178
Mushroom soil	24.7	1.1	6.9	141
New Jersey peat	88.9	3.2	5.5	410
Florida peat	93.1	3.3	5.4	506
New York peat	91.1	1.5	4.9	594

Grass clipping yields (table 7) are likely to indicate the usefulness of a soil treatment for turf maintenance. This does not necessarily mean, however, that excessively high yields of clippings are indicative of a good turf condition. Rate of decomposition of

TABLE 7.--Relative values for grass-clipping yields of golf-green plots (9).

Organic Material	Grass-clipping yields; 4-year average, 14 percent organic material added
Soil + 14 percent sand	100
Cocoa shells	213
Mushroom soil	148
New Jersey peat	122
Florida peat	107
New York peat	97

organic matter, together with nitrogen content, is likely to be a factor of importance in maintaining a good turf. Data showing the longevity of different kinds of organic matter are given in table 8.

TABLE 8.--Average percent loss of organic matter by decomposition during 4 years (average of 7-, 14-, and 21-percent mixtures) (9).

Organic Material	Original organic matter lost by decay
	Percent
Cocoa shells	74.9
Mushroom soil	32.8
New Jersey peat	28.1
Florida peat	27.0
New York peat	25.0

METHODS OF APPLYING ORGANICS

There are no standard methods for applying organics for soil or turf improvement. A few observations, however, lead to these generalizations:

- In a home garden and around shrubbery on institutional grounds located in the general area of Beltsville, Md., a sawdust mulch 1 to 1-1/2 inches thick is sometimes used.
- Weed growth is kept to a minimum.
- The humus supply of the soil is better maintained.
- Water infiltration is sometimes, but not always, seriously impaired,[3] but rate of evaporation is also usually diminished.
- The key to success lies in applying enough chemical nitrogen to offset any nitrogen deficiencies that otherwise might be in evidence.

[3] During the first few months of warm weather after application of a sawdust mulch, growth of fungi may be rapid. The fungal mat formed may shed considerable water at times.

Sawdust has been used successfully for turf establishment, as outlined below:

(1) Cover the soil with a 2-inch layer of sawdust plus 40 pounds of 10-10-10 grade fertilizer per 1,000 square feet. Lime if needed.

(2) Rototill or disk in the organic matter to a depth of 4 to 6 inches.

(3) Fertilize in a conventional manner, and plant seed or place sod.

Much better results may be expected if the sawdust is composted with an organic material, such as sewage sludge, prior to using it in the manner described above.

Compost may be prepared in the following manner:

(1) Mix equal parts of sawdust, sludge, and sand plus a small amount of a high-nitrogen fertilizer, such as 10-6-4.

(2) Spread 6 to 8 inches deep in a conveniently located area.

(3) Turn every 3 or 4 weeks during warm weather, using an appropriate implement, such as a rototiller or springtooth harrow.

(4) Water during dry periods.

(5) Use as needed.

Sawdust used for turf must always be well incorporated with soil. This method of placement in soil is usually applicable to other organics used essentially as soil conditioners. Domestic peat is frequently recommended for use in this way in Pennsylvania. The suggested rates are 1/2 cubic yard per 1,000 square feet for domestic lawns, and 1 to 3 cubic yards for recreational grounds, the rate depending somewhat upon prospective use of the area.

In the Washington, D. C., area digested sewage sludge has been successfully used as a surface application for established turf. The finely ground sludge is dumped in small piles from a truck, then scattered evenly by hand labor, making a layer about one-half inch thick over the surface. This treatment must be made during cold weather when grass is in a nearly dormant stage. The sludge works down between plants, leaving the leafy parts exposed.

The extensive turf investigations by DeFrance in Rhode Island (5) lead to a warning against use of organics in general for turf improvement in that area. He urges uniformity of topsoil, which is the keynote in sodding. Because of their tendency to promote bonding or layering of materials, use of peat moss and other organics should generally be avoided there. The following quotation of DeFrance (5, p. 2) sounds a warning note against use of organics in Rhode Island:

"If and when organic matter is needed, any of the following may be applied and thoroughly mixed with the topsoil to a depth of 6 inches by use of tiller machines or heavy disc-harrows: native peat or commercial humus--1,000 to 1,500 lbs. per 1,000 square feet; or well-rotted farm manure--1 cu. yd. per 1,000 square feet. Turf composed of basic lawn grasses builds up organic matter in the soil and on the surface from the disintegration of the roots and clippings. The need for additional organic matter such as peat moss in loamy soils is very questionable."

Climate as well as soil characteristics probably influences the usefulness of organics in soil management for turf. It should be noted here that average temperatures are lower, and the growing season is shorter, around Kingston, R. I., than in the metropolitan area of Washington, D. C.

No detailed explanation of the difference in effects of climate on turf treatments need be undertaken here. It is presumed possible that organics are more needed in areas such as Virginia and North Carolina than in New England. It seems probable in any case that the relatively rapid decomposition of organics under the warm, damp climatic conditions there leads to a need for applying more of such materials when establishing turf in the area.

The foregoing discussion sets forth facts and opinions regarding the use of natural organics for soil improvement. Specific recommendations regarding use of these materials under different conditions seem not justified at this time. It is suggested, however, that in extensive areas experimental use of organics has been neglected. Their application on a trial or experimental basis is desirable, wherein the fundamental information thus far made available is taken into account.

It is suggested that low-grade organics not be fortified with chemical forms of plant nutrients in advance of application, but that fertilizers containing these constituents be used as needed in conjunction with organics. The quantities needed will depend upon the kinds and quantities of organics applied, the soil characteristics, and the plants to be grown. In a circular of the U. S. Department of Agriculture (1) it is suggested that enough nitrogen be added to bring the content to at least 1.2 percent. Such advice would seem to be of general applicability (4). When phosphates and potash are known to be deficient--frequently the case in the Eastern States--they should be added to the soil as needed.

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